Remarks: Specification

A sentence was added to the Specification that explains a particular physical phenomena related to the invention. In particular, the phrase, "—This increase is attributed to the exploitation of both in-phase and quadrature-phase subcarriers, which is enabled by the complex-valued codes that map data to the individual time-domain pulses 1-5. —" was added.

Suggested Division of Independent Claims

Group I: Multicarrier transmission and Reception

A. Claims corresponding to FIG. 3F: Independent Claims 1, 9, 10, 11, 13, 14, 15, 19, 20, and 30.
B. Claims corresponding to FIG. 3G: Independent Claims 5, 16, 17, 18, 22, 23, 24, 27, 28, 29, and 31.

Group II: Communication System

Claim corresponding to FIG. 17A: Independent Claim 21.

Group III: Reception

Claims corresponding to FIGs. 28B and 29: Independent Claims 25 and 26.

Group IV: Feedback Method

Claim corresponding to FIGs. 33, 34, and 35: Independent Claim 32.

Applicant provisionally elects the Independent Claims in Group I, and thus, the corresponding Dependent Claims.

Detailed Explanation Linking Claims and Figures

Independent Claim 1 recites a multicarrier transmitter including a multicarrier signal generator, an information-signal generator, and a coupler. The above-recited functional components are shown in figures 3F, 11A, 25A, and 25B. Figure 6A shows these components except the coupler. Figures 18, 20A, 20B, 22A, 22B, 23, 24, 26, and 27 show transceiver apparatus and method embodiments that also include the recited components of Claim 1 and various embodiments thereof.

Independent Claim 5 recites a receiver system including a multicarrier phase adjuster, a combiner, and a time-domain receiver. The above-recited functional components are shown in FIG. 3G. In particular, the components 205A-N show equations with phase-adjustment terms $n\Delta\Phi$, combiner 109 (which produces a time-domain signal), and decision device 255, which processes the time-domain signal. This functionality is equivalently performed by the receiver shown in FIG. 3H, which projects the received signal onto the orthonormal basis of the transmitted signal. FIGs. 12, 13, 14D, and 25C show the above functional components with a variety of processes and elements.

Independent Claim 9 describes a method of virtual switching, which is also described as a phase-adjustment technique performed by a transmitter, such as shown in FIG. 3F and FIG. 11A. Actually, this technique is applicable to the function of any of the transmitters shown in the present patent application. A flow diagram corresponding to the virtual switching operation of the transmitter in FIG. 11A is shown in FIG. 11B.

Independent Claim 10 describes a method of addressing a multicarrier signal with respect to a dispersion profile, which is also a phase-adjustment technique performed by a transmitter, such as shown in FIG. 3F and FIG. 11A. This technique may be provided by any of the transmitter configurations disclosed in the present application. A flow diagram corresponding to the virtual switching operation of the transmitter in FIG. 11A is shown in FIG. 11B.

Independent Claim 11 recites a multicarrier signal transmitter including an information signal generator, an encoder, a predistortion device, a multicarrier signal generator, and a frequency converter. The above-recited functional components are shown in figures 3F, 6B, and 11A. Figures 18, 20A, 20B, 22A, 22B, 23, 24, 26, and 27 show transceiver apparatus and method embodiments that also include the recited components of Claim 11, except that the frequency converter is not explicitly shown.

Independent Claim 13 recites a multicarrier generation method including providing for generation of a plurality of carrier signals, providing for adjustment of at least one of a

set of amplitude and phase of at least one of the carrier signals, and providing for superposition of the carriers to generate a time-domain signal. The above-recited steps are shown in figures 3F, 6A, 6B, and 11A. Figures 18, 20A, 20B, 22A, 22B, 23, 24, 26, and 27 show transceiver apparatus and method embodiments that perform the recited steps of Claim 13.

Independent Claim 14 recites a multicarrier transmission method wherein carrier phase relationships between the carriers are selected to match a predetermined dispersion profile. This phase-adjustment technique is described with respect to the transmission techniques shown in FIG. 3F and FIG. 11A. This technique is applicable to the function of any of the transmitters shown in the present patent application. A related flow diagram corresponding to dispersion compensation (e.g., phase space addressing) by the transmitter in FIG. 11A is shown in FIG. 11B.

Independent Claim 15 recites a multicarrier transmitter capable of being used as a virtual switch in a waveguide. This is enabled by a phase-adjustment technique described with respect to the transmitters shown in FIG. 3F and FIG. 11A. This technique is applicable to the function of any of the transmitters shown in the present patent application. A related flow diagram corresponding to addressing (e.g., virtual switching) by the transmitter in FIG. 11A is shown in FIG. 11B.

Independent Claim 16 recites a multicarrier reception method including phase adjustment, combining phase adjusted multicarrier signals to produce a time-domain signal, and processing the time-domain signal. The above-recited steps are illustrated in FIG. 3G. In particular, the components 205A-N show equations with phase-adjustment terms $n\Delta\Phi$, combiner 109 (which produces a time-domain signal), and decision device 255, which processes the time-domain signal. This functionality is equivalently performed by the receiver shown in FIG. 3H, which projects the received signal onto the orthonormal basis of the transmitted signal. FIGs. 12, 13, 14D, and 25C include receivers adapted to perform the above steps with a variety of techniques.

Independent Claim 17 recites a receiver system including a phase-domain sampler, a weighting system, and a combiner. The above-recited functional components are shown in FIG. 3G. In particular, the components 205A-N show equations with phase-adjustment terms $n\Delta\Phi$ and components 205A-N also act as the weighting system to compensate for channel distortion. The combiner 109 and decision device 255 perform multi-user detection. Figures 18, 20A, 20B, 22A, 22B, 23, 24, 26, and 27 show transceiver apparatus and method embodiments that also include the recited components of Claim 17.

Independent Claim 18 recites a receiver system including a coupler, a frequency sampler, a phase processor, and a combining circuit. The functionality of this receiver is shown in FIG. 3G. FIGs. 12, 13, 14D, and 25C show different ways to implement the functional components recited in Claim 18. Figures 18, 20A, 20B, 22A, 22B, 23, 24, 26, and 27 show transceiver apparatus and method embodiments that also include the recited components of Claim 18.

Independent Claim 19 recites a multicarrier transmitter including a carrier-signal generator, a carrier-code generator, and an information-signal modulator. The above-recited functional components are shown in figures 3F, 6A and 11A. FIGS. 25A and 25B illustrate the functionality recited in Claim 19. Figures 18, 20A, 20B, 22A, 22B, 23, 24, 26, and 27 show transceiver apparatus and method embodiments that include various implementations for the recited components of Claim 19.

Independent Claim 20 recites a transmission method including providing for application of weights to a plurality of versions of at least one information signal, providing for coding the weighted information signals with at least one code having at least one diversity parameter, providing for application of a diversity process to the coded signals based on at least one additional diversity parameter, and providing for coupling the processed, coded signals into a communication channel. The above-recited functional components are shown in figure 3F. In particular, providing for application of weights to a plurality of versions of at least one information signal is shown by 104C. Providing for coding is shown by 104B. Providing for application of a diversity process to the coded

signals based on at least one additional diversity parameter is shown by 109, which generates a time-domain signal from the frequency-domain components. Providing for coupling is shown by 150. Figures 18, 20A, 20B, 22A, 22B, 23, 24, 26, and 27 show receiver apparatus and method embodiments that express specific embodiments of Claim 20.

Independent Claim 21 recites a communication system shown in FIG. 17A.

Independent Claim 22 recites a demultiplexing process that is illustrated generally by FIG. 3G. The steps recited in Claim 22 include providing for reception (shown by coupler 150), providing for separation of the carrier signals (shown by 205A-205N), providing for extraction of values of the information signals (shown by the array of samplers 214A-214N), and providing for separation of at least one information signal from at least one interfering signal (shown by combiner 109, which performs interferometry combining, and alternatively shown by decision device 255, which may perform multi-user detection or multi-channel detection). Figures 18, 20A, 20B, 22A, 22B, 23, 24, 26, and 27 show receiver apparatus and method embodiments that express specific spatial demultiplexing embodiments of Claim 22.

Independent Claim 23 recites a receiver shown in FIG. 3G having at least one sampler (shown by samplers 214A-214N), a separator (shown by converters 205A-205N), and a multi-user detector (shown by decision device 255, which may be adapted to perform multi-user detection). Figures 18, 20A, 20B, 22A, 22B, 23, 24, 26, and 27 show receiver apparatus and method embodiments that express specific embodiments of Claim 23.

Independent Claim 24 recites a receiver shown in FIG. 3G having at least one sampler (shown by samplers 214A-214N), a separator (shown by converters 205A-205N), a multi-user detector (shown by decision device 255, which may be adapted to perform multi-user detection), and a combiner (shown by combiner 109). Figures 18, 20A, 20B, 22A, 22B, 23, 24, 26, and 27 show receiver apparatus and method embodiments that express specific embodiments of Claim 24.

Independent Claim 25 recites a reception method illustrated in FIGs. 28B and 29.

Independent Claim 26 recites a receiver illustrated in FIGs. 28B and 29.

Independent Claim 27 recites a reception method shown in FIG. 3G including providing for reception of a plurality of multicarrier signals modulated with at least one information signal and at least one interfering signal wherein the multicarrier signals are separable with respect to at least one diversity parameter (shown by frequency-domain processing by converters 205A-205N, by samplers 214A-214N, and by combiner 109, which produces a time-domain signal from the frequency-domain signals), and providing for processing of the multicarrier signals with respect to at least one alternative diversity parameter that is different from the at least one diversity parameter (shown by decision device 255, which processes the time-domain signal from the combiner 109).

Independent Claim 28 recites a multicarrier receiver illustrated in FIG. 3G including a sampler (214A-214N), a combiner (109), and a multi-user detector (255).

Independent Claim 29 recites a reception method illustrated in FIG. 3G including providing for reception of a plurality of information-modulated multicarrier signals from a communication channel (shown by coupler 150), the multicarrier signals being modulated by at least one information signal and at least one interfering signal, providing for interferometry multiplexing of the received multicarrier signals in at least one diversity-parameter domain to obtain benefits of enhanced capacity (shown by converters 205A-205N, which provide phase decoding to the received carrier frequencies to demultiplex the information signals modulated on the same carriers), and providing for diversity combining of the received multicarrier signals in at least one diversity-parameter domain to obtain benefits of diversity (shown by combiner 109, which combines the frequency-domain signals to produce a time-domain signal).

Independent Claim 30 recites a multicarrier transmitter including a multicarrier-signal generator, a modulator, and a coupler. The above-recited functional components are shown in figures 3F and 11A. For example, in FIG. 3F, modulation 104A illustrates an information signal being modulated onto a plurality of carrier signals, and coupler 150 couples the transmission into a communication channel. Figures 18, 20A, 20B, 22A, 22B, 23, 24, 26, and 27 show transceiver apparatus and method embodiments that also include variations of the recited components of Claim 30.

Independent Claim 31 recites a reception method including providing for reception of a plurality of information-modulated sets of multicarrier signals, each set containing a plurality of multicarrier signals, each of the multicarrier signals having a different value of at least one diversity parameter, each set being characterized by a different value of at least one diversity parameter, providing for separating the sets, providing for combining the information-modulated multicarrier signals in each set to provide a plurality of information-modulated sets, and providing for interferometry demultiplexing the information-modulated sets to separate at least one information signal from at least one interference signal. This reception method is illustrated in FIG. 3G, which shows a coupler 150, combiner 109, and converters 205A-205N (which process the received carrier frequencies prior to combining for enabling interferometry demultiplexing). Also, decision device 255 may perform interferometry demultiplexing when it functions as a multi-user detector or multi-channel detector.

Independent Claim 32 recites a feedback method illustrated in FIGs. 33, 34, and 35.

Dependent Claims 2-4 are illustrated by the same figures corresponding to Independent Claim 1.

Dependent Claims 6-8 are represented by the same figures corresponding to Independent Claim 5.

Dependent Claims 33-39 correspond to the same figures associated with Independent Claim 11.

Dependent Claims 40-48 correspond to the same figures associated with Independent Claim 13.

Dependent Claims 49-56 correspond to the same figures associated with Independent Claim 16.

Dependent Claims 57-64 correspond to the same figures associated with Independent Claim 18.

Dependent Claims 65-79 correspond to the same figures associated with Independent Claim 19.

Dependent Claims 80-81 correspond to the same figures associated with Independent Claim 20.

Dependent Claims 82-83 correspond to the same figures associated with Independent Claim 22.

Dependent Claims 84-87 correspond to the same figures associated with Independent Claim 23.

Dependent Claims 88-95 correspond to the same figures associated with Independent Claim 27.

Dependent Claims 96-99 correspond to the same figures associated with Independent Claim 28.

Dependent Claims 100-109 correspond to the same figures associated with Independent Claim 29.

Dependent Claims 110-118 correspond to the same figures associated with Independent Claim 30.

Dependent Claims 119-123 correspond to the same figures associated with Independent Claim 31.

Very respectfully,

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